AMENDMENTS TO THE CLAIMS

1.   (Currently Amended) A method for detecting a position of a mobile robot, the method comprising:

storing position numbers for discriminating positions of a plurality of ultrasonic signal reception units;

oscillating ultrasonic signals sequentially using a plurality of ultrasonic signal oscillating units of a charging station after receiving a radio frequency (RF) signal emitted at preset time intervals from the mobile robot;

calculating time taken for each ultrasonic signal generated ~~by a~~by the plurality of ultrasonic signal oscillating units ~~of a~~of the charging station to reach the mobile robot~~, wherein the ultrasonic signals are oscillated sequentially after receiving a radio frequency (RF) signal emitted at preset time intervals from the mobile robot~~;

calculating a distance between the charging station and the mobile robot based on the calculated reaching time;

calculating an angle between the charging station and the mobile robot based on the calculated distance value and a preset distance value between the plurality of ultrasonic signal oscillating units; and

~~prestoring position numbers for discriminating positions of at least one or more ultrasonic signal reception units for receiving the ultrasonic signals, among a plurality of ultrasonic signal reception units, in order to detect a~~detecting a proceeding direction ~~that~~of the mobile robot ~~proceeds~~by receiving the ultrasonic signals.

2.   (Previously Presented) The method of claim 1, wherein the angle between the charging station and the mobile robot is calculated through triangulation based on the calculated distance value and the preset distance value between the plurality of ultrasonic signal oscillating units.

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3.   (Canceled)

4.   (Canceled).

5.   (Original)   The method of claim 1, further comprising adding a semidiameter of the mobile robot to the distance value between the charging station and the mobile robot.

6.   (Original) The method of claim 1, wherein the distance value between the charging station and the mobile robot is detected through expression S=340[m/sec] x (T1-T2), wherein 340[m/sec] is sound velocity, T1 is time taken to receive an ultrasonic signal, and T2 is time taken to oscillate an ultrasonic signal after receiving an RF signal.

7.   (Canceled).

8.   (Currently Amended) An apparatus for detecting a position of a mobile robot, the apparatus comprising:

an RF generating unit installed at a mobile robot and configured to emit an RF(Radio Frequency) signal at preset time intervals;

an RF reception unit installed at a charging station and configured to receive the RF signal emitted by the RF generating unit;

a plurality of ultrasonic signal oscillating units each installed at the charging station and for oscillating ultrasonic signals based on a point of time at which the radio frequency signal is emitted;

a control unit configured to control the ultrasonic signal oscillating units so that the ultrasonic signals are oscillated sequentially whenever the RF signal is received by the RF reception unit;

a plurality of ultrasonic signal reception units each installed on an outer circumferential surface of the mobile robot and configured to receive the ultrasonic signals oscillated by the plurality of ultrasonic signal oscillating units; and

a microcomputer installed in the mobile robot and configured to calculate a distance and an angle between the mobile robot and the charging station based on reaching time taken for each ultrasonic signal to reach the mobile robot and a preset distance value between the plurality of ultrasonic signals oscillating units, and to estimate a position of the mobile robot based on the calculated distance value and angle value,

wherein the microcomputer further comprises a storing unit configured to store position numbers for discriminating positions of the plurality of ultrasonic signal reception units, and detects a direction that the mobile robot proceeds through the stored position number of the ultrasonic signal reception unit which has received the ultrasonic signal first among the plurality of ultrasonic signal reception units.

9.   (Currently Amended) The apparatus of claim 8, wherein the microcomputer compensates a position error of the mobile robot generated by sliding of the wheel or idle rotation based on the estimated position of the mobile robot estimated from the calculated distance value and angle value.

10.   (Previously Presented) The apparatus of claim 8, wherein the plurality of ultrasonic signal oscillating units are installed to be symmetric to each other in a horizontal direction of the charging station.

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11.   (Previously Presented) The apparatus of claim 8, wherein the plurality of ultrasonic signal oscillating units are installed to be symmetric to each other in vertical and horizontal directions at the charging station.

12.   (Previously Presented) The apparatus of claim 8, wherein the microcomputer detects a reaching time taken for each ultrasonic signal to be received by one or more ultrasonic signal reception units among the plurality of ultrasonic signal reception units after being oscillated by the plurality of ultrasonic signal oscillating units on the basis of a point of time at which the RF signal is generated; calculates a distance between the mobile robot and the charging station based on the detected reaching time; and calculates an angle between the mobile robot and the charging station through triangulation based on the detected reaching time and the preset distance value between the plurality of ultrasonic signal oscillating units.

13.   (Canceled).

14.   (Previously Presented) The apparatus of claim 8, wherein when the ultrasonic signals are received by two or more ultrasonic reception units among the plurality of ultrasonic signal reception units, the microcomputer calculates a reaching time taken for each ultrasonic signal to be received by the two or more ultrasonic signal reception units; selects two ultrasonic signal reception units among the plurality of ultrasonic signal reception units which have received ultrasonic signals whose reaching time is the fastest, among the calculated reaching time values; and calculates a distance between the mobile robot and the charging station based on the reaching time of the ultrasonic signals which have been received by the two selected ultrasonic signal reception units.

15.   (Original) The apparatus of claim 8, wherein the microcomputer detects the distance between the charging station and the mobile robot through expression S=340[m/sec] x

(T1-T2), wherein 340[m/sec] is sound velocity, T1 is time taken to receive an ultrasonic signal, and T2 is time taken to oscillate an ultrasonic signal after receiving an RF signal.

16.   (Canceled).

17.   (Canceled).

18.   (Previously Presented) An apparatus for detecting a position of a mobile robot, the apparatus comprising:

an RF generating unit installed at a mobile robot and configured to emit an RF(Radio Frequency) signal;

an RF reception unit installed at a charging station and configured to receive the RF signal emitted by the RF generating unit;

a plurality of ultrasonic signal oscillating units each installed at the charging station and for oscillating ultrasonic signals;

a control unit configured to control the ultrasonic signal oscillating units so that the ultrasonic signals are oscillated sequentially whenever the RF signal is received by the RF reception unit;

a plurality of ultrasonic signal reception units each installed on an outer circumferential surface of the mobile robot and configured to receive the ultrasonic signals oscillated by the plurality of ultrasonic signal oscillating units; and

a microcomputer installed in the mobile robot and configured to calculate a distance and an angle between the mobile robot and the charging station based on reaching time taken for each ultrasonic signal to reach the mobile robot and a preset distance value between the plurality of ultrasonic signals oscillating units,

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wherein when the ultrasonic signals are received by two or more ultrasonic signal reception units among the plurality of ultrasonic signal reception units, the microcomputer calculates reaching time taken for each ultrasonic signal to be received by the two or more ultrasonic signal reception units; selects two ultrasonic signal reception units which have received ultrasonic signals whose reaching time is the fastest, among the calculated reaching time values; and calculates a distance between the mobile robot and the charging station based on the reaching time of the ultrasonic signals which have been received by the two selected ultrasonic signal reception units.

19. (New) The method of claim 1, wherein, wherein when the ultrasonic signals are detected only in one of the ultrasonic signal reception units, calculating a distance value between the one of the ultrasonic signal reception units and the charging station based on a reaching time of each of the detected ultrasonic signals, and calculating an actual distance between the mobile robot and the charging station by adding a semidiameter of the mobile robot to the calculated distance value, and

wherein, when the ultrasonic signals are detected by two or more ultrasonic signals reception units, calculating a reaching time taken for each ultrasonic signal to be received by the two or more ultrasonic signal reception units, selecting two ultrasonic signal reception units which have received ultrasonic signals whose reaching time is the fastest, among the calculated reaching time values, and calculating a distance between the mobile robot and the charging station based on the reaching time of the ultrasonic signals which have been received by the two selected ultrasonic signal reception units.

20. (New) The apparatus of claim 8, wherein when the ultrasonic signals are detected only in one of the ultrasonic signal reception units, the microcomputer calculates a distance value between the one of the ultrasonic signal reception units and the charging station based on a reaching time of each of the detected ultrasonic signals, and calculates an actual distance

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between the mobile robot and the charging station by adding a semidiameter of the mobile robot to the calculated distance value, and

wherein, when the ultrasonic signals are received by two or more ultrasonic signal reception units among the plurality of ultrasonic signal reception units, the microcomputer calculates reaching time taken for each ultrasonic signal to be received by the two or more ultrasonic signal reception units, selects two ultrasonic signal reception units which have received ultrasonic signals whose reaching time is the fastest, among the calculated reaching time values, and calculates a distance between the mobile robot and the charging station based on the reaching time of the ultrasonic signals which have been received by the two selected ultrasonic signal reception units.

21. (New) The apparatus of claim 18, wherein when the ultrasonic signals are detected only in one of the ultrasonic signal reception units, the microcomputer calculates a distance value between the one of the ultrasonic signal reception units and the charging station based on a reaching time of each of the detected ultrasonic signals, and calculates an actual distance between the mobile robot and the charging station by adding a semidiameter of the mobile robot to the calculated distance value.

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